IN THE ABSTRACT:

Delete the "Abstract"on the PCT cover sheet and replace it with the "Abstract of the Disclosure" set forth on a separate sheet attached hereto.

REMARKS

An abstract has been provided on a separate sheet; and the claims have been amended to conform to U.S. practice.

Wherefore, an early action on the merits is earnestly solicited.

Respectfully submitted,

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PROPOSED NEW CLAIMS

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21. A phase-shifter comprising:

a) phase-altering means for introducing a phase shift into a signal having a phase which is to be controlled; and

b) an actuator having a shape which changes in response to an electrical control signal, the actuator being mechanically connected to the phase-altering means such that a change in the shape of the former leads to a phase-altering action in the latter, the actuator comprising a tubular stator of piezoelectric or magnetostrictive material, a piston coaxially disposed within the stator, and a bearing member disposed between the stator and the piston, the stator distorting in an approximately frusto-conical manner in response to the control signal, thereby causing the bearing member to roll axially along the stator and, in turn, causing axial movement of the piston.

22. The phase-shifter according to claim 21, in which the stator comprises a piezoelectric tubular member having an electrode structure on its internal and external, curved surfaces for coupling to a source of a control voltage, and in which the bearing member is an elastically deformable member of approximately annular cross-section.

23. The phase-shifter according to claim 22, in which the stator has a slot extending completely through a wall of the tubular member and which describes a helical path about the tubular member.

24. The phase-shifter according to claim 21, in which the phase-altering means comprises a reflecting member attached to the piston, the reflecting member being disposed inside a waveguide arrangement, whereby application of a control voltage to the actuator causes the

reflecting member to move inside the waveguide arrangement, thereby altering a path length of a signal propagated along the waveguide arrangement.

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25. The phase-shifter according to claim 24, in which the waveguide arrangement comprises first and second parallel waveguides having cavities communicating with each other over at least a part of their common length, the first waveguide containing a radiating element for producing radiation to be propagated along the first waveguide toward the reflecting member, and the second waveguide having a radiating aperture, wherein, in use, the radiation propagating in the first waveguide is reflected from the reflecting member into the second waveguide and out through the radiating aperture.

26. The phase-shifter according to claim 21, in which the phase-altering means comprises a waveguide containing one or more fixed dielectric slabs made of a material of a first dielectric constant fixed to the waveguide, and a movable dielectric slab made of a material of a second dielectric constant disposed in cooperating relationship with the one or more fixed slabs, the movable slab being connected to the piston.

27. The phase-shifter according to claim 26, in which the one or more fixed slabs are secured to an inside surface of a wall of the waveguide and define a laterally substantially central cavity free from dielectric material, and wherein the movable slab is arranged to be axially movable within said substantially central cavity.

28. The phase-shifter according to claim 27, in which the waveguide is attached to one end of the stator, and in which the movable slab is connected to the piston by means of a push rod.

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29. The phase-shifter according to claim 27, in which the piston is hollow, and in which the waveguide is disposed in the piston.

30. The phase-shifter according to claim 29, in which the movable slab is connected to the piston by means of connecting arms projecting radially inwardly from the piston and located inside axially oriented slots provided in the waveguide wall and in the one or more fixed slabs.

31. The phase-shifter according to claim 30, and further comprising a launcher provided in the waveguide wall at a location not occupied by the slabs, the launcher serving to generate a wave which passes through the slabs and out through a radiating aperture of the waveguide.

32. The phase-shifter according to claim 26, in which said first dielectric constant is approximately the same as said second dielectric constant.

33. The phase-shifter according to claim 21, in which the phase-altering means comprises a dielectric gel contained within a waveguide.

34. The phase-shifter according to claim 33, in which the dielectric gel is contained within a bag having an outer surface which is attached to an inner surface of a wall of the waveguide, and a transversely central end-portion which is connected to the piston.

35. The phase-shifter according to claim 34, in which the piston is attached to the bag by way of a movable dielectric slab.

36. The phase-shifter according to claim 35, in which the movable slab and the gel have approximately the same dielectric constant.

37. A steerable phased array antenna system, comprising:

a) an input to supply a signal to the system;

b) a splitter to split the signal into a plurality of sub-signals; and

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c) a plurality of antenna elements to transmit the sub-signals, the antenna elements having associated phase-shifting means to phase-shift the sub-signals so that the system transmits and steers the signal in a chosen direction, each of the phase-shifting means comprising a phase-shifter including phase-altering means for introducing a phase shift into a signal having a phase which is to be controlled, and an actuator having a shape which changes in response to an electrical control signal, the actuator being mechanically connected to the phase-altering means such that a change in the shape of the former leads to a phase-altering action in the latter, the actuator comprising a tubular stator of piezoelectric or magnetostrictive material, a piston coaxially disposed within the stator, and a bearing member disposed between the stator and the piston, the stator distorting in an approximately frusto-conical manner in response to the control signal, thereby causing the bearing member to roll axially along the stator and, in turn, causing axial movement of the piston.

38. The steerable phased array antenna system according to claim 37, and further comprising a power amplifier connected between the input supplying the signal to the system and the splitter.

39. A steerable phased array antenna, comprising:

a) a plurality of receiving antenna elements having associated phase-shifting means to phase-shift signals supplied by the antenna elements; and

b) a combiner connected to the phase-shifting means to combine the phase-shifted signals, the phase-shifting means comprising a phase-shifter including phase-altering

. means for introducing a phase shift into a signal having a phase which is to be controlled, and an actuator having a shape which changes in response to an electrical control signal, the actuator being mechanically connected to the phase-altering means such that a change in the shape of the former leads to a phase-altering action in the latter, the actuator comprising a tubular stator of piezoelectric or magnetostrictive material, a piston coaxially disposed within the stator, and a bearing member disposed between the stator and the piston, the stator distorting in an approximately frusto-conical manner in response to the control signal, thereby causing the bearing member to roll axially along the stator and, in turn, causing axial movement of the piston.

40. The steerable phased array antenna according to claim 39, and further comprising a plurality of amplifiers connected between respective phase-shifting means and the combiner.